

WHAT IS CLAIMED IS:

1. A composite structure comprising:  
an inorganic thin film having a defined mesostructure formed in a surfactant based formation process including a non-cationic surfactant template material; and,  
a conjugated polymer immobilized within said mesostructured inorganic thin  
5 film.
2. The composite structure of claim 1 wherein said conjugated polymer is water-soluble.
3. The structure of claim 1 wherein said conjugated polymer is poly(2,5-methoxy-propyloxy sulfonate phenylene vinylene).
4. The structure of claim 1 wherein said surfactant based formation process includes a surfactant selected from the group of anionic surfactants and neutral surfactants.
5. The structure of claim 2 wherein said inorganic thin film is of silica.
6. A sensor comprising:  
a responsive element for a detectable species, said responsive element including a nanocomposite structure of an inorganic thin film having a defined mesostructure and a conjugated polymer immobilized within said mesostructured inorganic  
5 thin film; and,  
a detector means for detecting a response of said responsive element upon exposure to said detectable species.
7. The sensor of claim 6 wherein said mesostructure is defined during a surfactant based formation process.
8. The sensor of claim 6 wherein said conjugated polymer is poly(2,5-methoxy-propyloxy sulfonate phenylene vinylene).
9. The sensor of claim 6 wherein said surfactant based formation process includes a surfactant selected from the group of cationic surfactants, anionic surfactants and neutral surfactants.
10. The sensor of claim 6 wherein said responsive element is essentially fully reversible.
11. The sensor of claim 11 wherein said surfactant is a neutral block co-polymer.

12. The sensor of claim 6 wherein said inorganic thin film is of silica.

13. A method of detecting trace amounts of nitro-containing organic species within an environment comprising:

placing a selected chemical sensor into an environment, said sensor including a responsive element for said detectable nitro-containing organic species, said responsive  
5 element including a nanocomposite structure of an inorganic thin film having a defined mesostructure and a conjugated polymer immobilized within said mesostructured inorganic thin film, said sensor element adapted for a chemical interaction of a nitro-containing organic species therewith, for a sufficient time wherein nitro-containing organic species can have a chemical interaction with said responsive element;

10 measuring a change resulting from said chemical interaction of nitro-containing organic species with said responsive element; and,

correlating said measured change with a quantitative or qualitative output relating to said nitro-containing organic species.

14. The method of claim 13 wherein said conjugated polymer is poly(2,5-methoxy-propyloxy sulfonate phenylene vinylene).

15 15. The method of claim 13 wherein said surfactant based formation process includes a surfactant selected from the group of cationic surfactants, anionic surfactants and neutral surfactants.

16. The method of claim 13 wherein said responsive element is essentially fully reversible.

17. The method of claim 13 wherein said surfactant is a neutral block copolymer.